

Advanced Seminar in Biometrics

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da/sec - Biometrics and Security Research Group, Hochschule Darmstadt

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Contact and Website

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advanced-seminar-ws22-23-rathgeb-ibsen-priesnitz/`

Procedure

- ▶ Students select preferred topics and groups (up to 2 students depending on the topic)
- ▶ Required materials will be handed over by the supervisors: databases, software, evaluation scripts etc.
- ▶ **Progress reports** have to be sent to the supervisor(s) before the following dates:
 - 1) 30th November
 - 2) 16th January
- ▶ Additional appointments shall be arranged individually and on demand.

Procedure (cont'd)

- ▶ Each group has to prepare a term paper (6-8 pages) using the IEEE conference template: <https://www.ieee.org/conferences/publishing/templates.html>
- ▶ The term paper must be submitted by **1st March**
- ▶ The final presentation will be 45 minutes per group + 15 minutes discussion of the results
- ▶ Suggested dates for the final presentations: **mid March** (Doodle voting)
- ▶ A grade will be given based on the term paper and final presentation

Overview

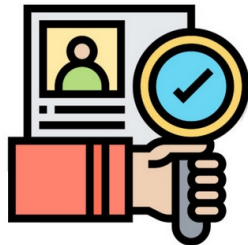
- ▶ Training Human Face Manipulation Detection
- ▶ No-reference Image Quality for Contactless Fingerprints
- ▶ Face Recognition for People with Down Syndrome
- ▶ Fingertip detection using Google MediaPipe Hands
- ▶ Easy Ways for Face Image Quality Estimation
- ▶ Hands On: Attacking Contactless Fingerprint Recognition
- ▶ Suspicious Behaviour in Access Control

Training Human Face Manipulation Detection

The detection of manipulated face images, e.g. DeepFakes, is quite difficult for humans. Further, their self assessment differs a lot which motivates a deeper subject-specific analysis of detection results based on machine learning. This may improve the overall accuracy.

- ▶ **Tasks:** Machine learning-based analysis of human detection scores
- ▶ Design of learning algorithm
- ▶ Evaluation of detection performance

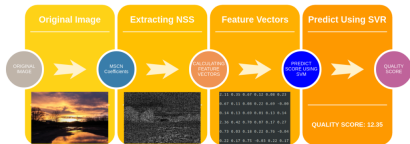
- ▶ **Documentation:** Term paper, presentation
- ▶ **Handout:** Literature, detection scores
- ▶ **Supervisors:** C. Rathgeb, M. Ibsen



No Reference Image Quality for Contactless Fingerprints

Contactless fingerprint recognition lacks a robust quality assessment algorithms. The task of this project is to evaluate no reference image quality estimation tools for contactless fingerprint images.

- ▶ **Tasks:** Set up two general purpose image quality estimation tools (e.g. DoM, BRISQUE, NIQE)
- ▶ Find a suitable pre-processing for contactless fingerprints (e.g. cropping, resizing) and evaluate the algorithms on a given contactless fingerprint database
- ▶ **Documentation:** Pre-processing Pipeline, Term paper, presentation
- ▶ **Handout:** ISFPDv1 database, paper and tutorials as starting points, evaluation framework
- ▶ **Supervisor:** J. Priesnitz



Face Recognition for People with Down Syndrome

Face recognition algorithms have been found to work well on data they have been trained on. Often this is not the case for minorities like people with down syndrome. It is unclear whether face recognition technologies are working properly for them.

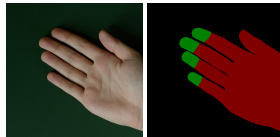
- ▶ **Tasks:** Collection of face database
- ▶ Recognition performance evaluation
- ▶ Comparison with other demographic groups
- ▶ **Documentation:** Term paper, presentation
- ▶ **Handout:** Evaluation software, ISO biometric standards
- ▶ **Supervisors:** C. Rathgeb, M. Ibsen



Fingertip detection using Google MediaPipe Hands

Fingertip detection is a crucial part for contactless fingerprint recognition. The goal is to explore the capabilities of Google MediaPipe hands for fingertip detection.

- ▶ **Tasks:** Modify a given machine learning database to identify the finger IDs.
- ▶ Re-train a given machine learning model
- ▶ Validate your model
- ▶ **Documentation:** Term paper, presentation
- ▶ **Handout:** Software, ML-model, ISO biometric standards
- ▶ **Supervisors:** J. Priesnitz



Easy Ways for Face Image Quality Estimation

Many complex algorithms have been designed to estimate the sample quality of a face image. A simple method could be based on the symmetry of the extracted feature vector. This has not been explored and would have operational advantages.

- ▶ **Tasks:** Implementation of simple face quality assessment for different feature extractors
- ▶ Evaluation of predictive power for face recognition performance
- ▶ **Documentation:** Term paper, presentation
- ▶ **Handout:** Face recognition software, evaluation software, ISO biometric standards
- ▶ **Supervisors:** C. Rathgeb, T. Schlett



Hands On: Attacking Contactless Fingerprint Recognition

Presentation Attack Detection (PAD) in contactless fingerprint recognition is more challenging compared contact-based modalities because many detection mechanisms rely on direct contact between the finger and the surface of the capture device. Hence, in contactless scenarios it is possible to present more presentation attack instruments.

- ▶ **Tasks:** Capture presentation attacks using a given Android App.
- ▶ Train and validate a CNN for presentation attack detection
- ▶ **Documentation:** Term paper, presentation
- ▶ **Handout:** Android smartphone incl. App, ML-model, hands
- ▶ **Supervisors:** J. Priesnitz



Suspicious Behaviour in Access Control

Criminals may try to circumvent access control mechanism, e.g. automated border control. Attacks on biometric systems may not only be detected by according sensors and software but by the attackers behaviour. This is especially the case in semi-controlled environments.

- ▶ **Tasks:** Survey published scientific literature
- ▶ Develop a categorisation and taxonomy
- ▶ **Documentation:** Term paper, presentation
- ▶ **Handout:** Literature to start, ISO biometric standards
- ▶ **Supervisors:** C. Rathgeb



Select your own topic

- ▶ Students are also invited to proposed their own topic!

Topic selection process

- ▶ Send your topic choice to `christian.rathgeb@h-da.de` by the end of the week
- ▶ First come, first serve – so you might choose more than one topic (1st and 2nd choice)